TRMM/GPM Climatology and Inter-Annual Variations

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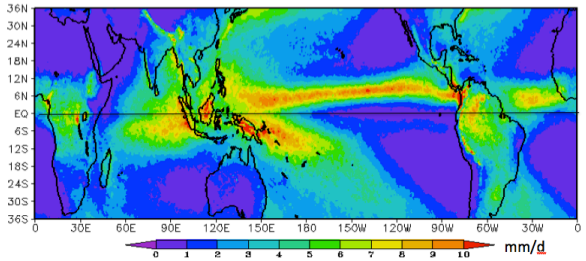
Objectives

- *Utilize data from TRMM and GPM multiple instruments and algorithms to develop Tropical Composite Climatology (TCC) for water balance and other studies.*
- *Analyze large-scale inter-annual variations of rainfall with both PMW and radar observations in relation to surface temperature and understand differences between radar and PMW results.*

Fifteen-year (1998-2012) TRMM Composite Climatology (TCC)



TCC and components mean ocean values very similar to GPCP and recent CloudSat/PR study

Tropical Mean (Ocean) Rainfall Estimates

mm/d	TMI (2A12)	Combined (2B31)	PR (2A25 NS– Adjusted for Boost)	TRMM Composite Climatology (TCC)*	GPCP	TRMM PR + CloudSat**
35N-35S (ocean)	2.8	3.0	2.9	2.9	2.9	3.0

*Adler et al. 2009 JMSJ; Wang et al. 2013 JClim

**Behrangi et al., 2014 JClim

Mean Precipitation (mm/day) of 25S-25S (ocean) during March 2014-August 2014

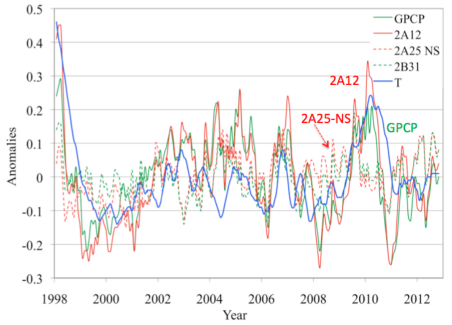
	Near Sfc.	2km	4km	6km
TRMM PR	3.0	2.8	2.0	0.5
GPM DPR	3.2	2.9	2.0	0.4
TMI	2.7			
GMI	3.3			

Preliminary results from TRMM/GPM overlap indicates early GPM products significantly higher than TRMM Version 7

Inter-annual Variations

(Differences between PMW and Radar)

Time Series of Ocean (35N-35S) Rain and Surface Temperature Anomalies for TRMM Era (1998-2012)

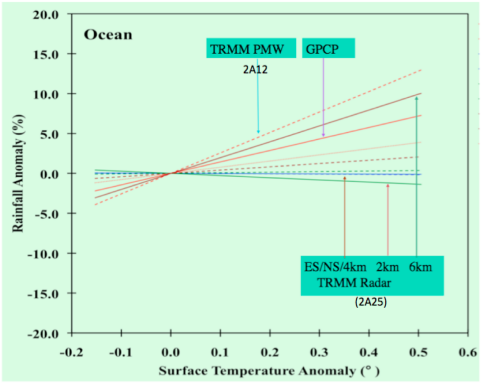


2010-2011 El Nino/La Nina Event

Amplitude of Rain Anomalies:

2A12 0.6 mm/d
GPCP 0.5
2A25 0.25
(with different phase)

Slopes of Inter-Annual Tropical Ocean SST and Rainfall Anomalies

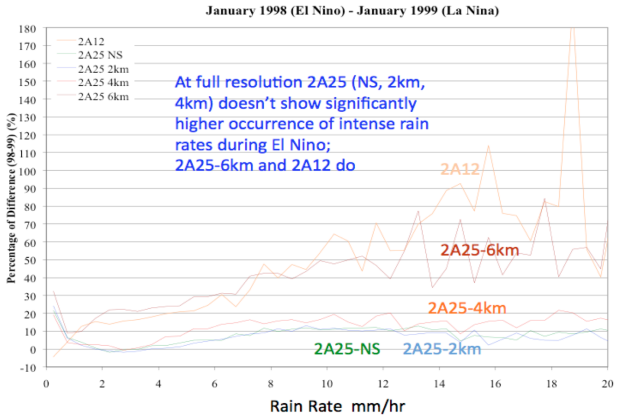


Passive microwave shows 12-20%/C rainfall changes with SST changes (as does PR at 6 km)

PR (below 6 km) shows near zero slope

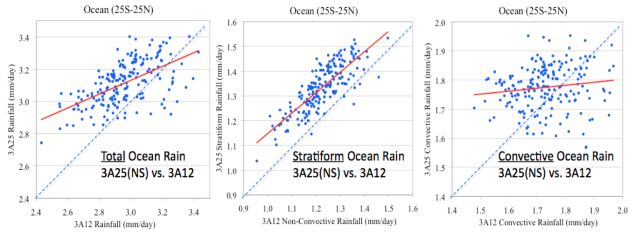
They both can't be right!

Pixel by Pixel Histograms—Difference between Jan. '98 and Jan. '99



Histogram differences of TMI and PR (NS) ocean instantaneous rainrate in Jan. 1998 (El Niño [warm]) and Jan. 1999 (La Niña [cool]

Inter-annual Variations of Ocean Tropical Rain (Passive Microwave vs. Radar)



Inter-annual correlation differences in total ocean rain due solely to convective portion (right panel). Results point to problem with attenuation correction underestimation in convective/heavier rain

Conclusions and Future Work

- **Version 7 TRMM total ocean climatological value agrees well with other current estimates. Preliminary GPM values from TRMM/GPM overlap are higher. Climatology will be re-done with GPM data added and expanded into extratropics.**
- **The PR-based surface precipitation-temperature slopes do not confirm slopes based on passive microwave observations—which is correct? Problem likely due to PR underestimating convective rain, especially larger values, probably due to attenuation correction limitation. GPM radar mean ocean profile may show smaller drop-off toward surface as compared to TRMM (see table above). PR/DPR and inter-annual diagnostics will continue, especially for current El Nino.**